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26 JAN 1968

MEMORANDUM FOR: Director of Strategic Research

SUBJECT: OSR ADP Programs

Following is a compilation of information presented during briefings on OSR ADP programs on 17 January 1968:

I. SCAM ADP Program 25X1A9a

Responsible Branch: PA/C [redacted]

1. Description:

SCAM is a large, complex computerized data processing system that generates defense expenditure data. The output format of the system presents the data both in terms of military missions and functions and in terms of economic resource categories. It can accomodate a 30-year time span and expresses the data in two currencies. At the most detailed level, the data is available by specific type of organizational unit or weapon system and at the other extreme total defense expenditures are provided. Recently, a capability for limited graphic display of output has been added to the system.

There are approximately 450 distinct O/B units in the system that serve as basic cost generating centers. Expenditures for as many as about 20 separate accounts may be computed for each unit on an annual basis in both rubles and dollars for a 30-year time span. In addition, there are approximately 400 procurement items in the system for which expenditures are computed on an annual basis in rubles and dollars and the results are added to unit related expenditures to obtain totals. From the point of view of OCS, the SCAM project is among the top 2 or 3 intelligence applications in terms of man-hours, machine time, and over-all complexity. At the present time the largest single allocation of manpower within the Special Applications Branch of the Intelligence Support Division is for the SCAM project.

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The system is basically computational in nature rather than a storage and retrieval system. The need to manipulate and move data within the system and the large amount of data stored are what make the system highly complex.

Although designed for a specific purpose, there has been useful "spin-off" from the system -- e.g., military machinery index for OER, aircraft production runs for TF/A.

2. Objective of the System:

To provide reliable expenditure implications of estimated, postulated, or projected Soviet military force structures that are responsive in both format and timing to the needs of consumers (including OSR). (Note: Reliable in the sense that the calculations are accurate.) Following is a more detailed discussion of the service provided to consumers by SCAM:

The National Estimating Process: Ideally, the expenditure implications would serve a two-fold purpose in this connection. First, the expenditure data reflecting OSR's force structure judgments, can serve as an input to the deliberative process by providing the basis for generalized cost-effectiveness analysis. Second, at the completion of the estimating process, the military expenditure data can provide to the planners, policy-makers, and the community in general the economic implications of the conclusions reached in the National Estimates.

OSD (Systems Analysis): US defense planners have been a major consumer both indirectly through the national estimating process and directly by means of special ad hoc studies -- e.g., the Valtz Ground Forces Expenditure Study and the Selin Greater Than Expected Threat Study.

DIA: Relies on the output of SCAM system and its underlying basic input data -- e.g., prices -- to service the specialized requirements of the JCS and the military services.

OSR: Last, but certainly not least, is our own continuing requirement for a current expenditure series

that reflects the best judgments of the Office on the Soviet military forces and programs. Such a series is necessary to support a wide range of Office intelligence production -- e.g., current support (budget announcements), major publications [redacted] high-level briefing (NSC), etc.

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3. Current Status:

a. Processing of Information

In strictly mechanical or technical terms, the system has been operating in a highly successful manner for some time. A deficiency that recent events have made obvious is the inability of a system to rapidly and conveniently take account of major changes in the level of operational activity of the forces. In terms of the data analysis and preparation that must be performed in PA/C to complete an expenditure run, several developmental efforts are now in process or are planned which will appreciably increase the efficiency of the system -- e.g., the nuclear weapons sub-routine and the land armaments procurement sub-routine.

b. Availability of Required Force Structure Data

The timely and successful operation of the SCAM system is very heavily dependent upon the availability to PA/C of basic input data supplied by other OSR components (and to a limited extent OER). Despite the fact that the mechanisms used for obtaining the necessary data usually have been rather informal, have varied over time, and have been somewhat haphazard, we have been able for the most part to meet the needs of consumers for the expenditure data. A major exception to this generalization is that we have been generally unable to provide expenditure implication data to support the deliberative process of the national estimates because the force structure numbers have not been available in time. I believe that the design and implementation of a more systemative mechanism for obtaining the basic input data could greatly improve the over-all process. A great deal of the unpredictability (both from the point of view of PA/C and the contributing branches) could be removed from the present

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arrangement, the burden on the contributing branches could be reduced, and perhaps most importantly the inputs could be subjected to more thorough review at the appropriate echelons.

4. Outlook for the Future:

a. Production

Each year over the past several, the number of expenditure runs made has increased. This trend will probably continue -- e.g., China or the necessity for two runs for each NIE when OSR's position differs appreciably. Each run requires about 1,000 man-hours in PA/C. We are unable to estimate the workload that this implies for the contributing branches.

b. Computer System Developments

Considerable effort both within the branch and within OCS will be devoted to continuing the refinement of the existing system to improve its capabilities and efficiency.

c. Information Processing

In conjunction with the appropriate people work up a proposal for insuring the availability of basic input data to the costing process.

5. Postscript:

The use of the SCAM system entails a discipline that might be considered a mixed blessing. This stems from the fact that broad generalizations are not costable and it is at least conceivable that such generalizations, which superficially appear reasonable, may not hold up when subjected to detailed scrutiny for costing purposes. On the other hand, working out the detailed implications is often a painstaking and expensive effort.

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II. SAM Order of Battle File

Responsible Branch: SF/D [redacted]

1. Description:

SAM order of battle was maintained manually until 1962 when the present system was established with OCS help. Our file is essentially an expanded and re-formatted edition of SAM data supplied by DIA. Data 25X1B0a
25X1B0a which we add to the TDI base includes: [redacted] political sub-division, military district, targeting data, and collateral reports.

2. Objective of the System:

We use the file for special research projects, background, and for quick reference. This file provides more timely and complete data on current SAM order of battle than is available in the published TDI.

3. Current Status:

The file's shortcomings are: (1) the SECRET classification which restricts our inputs, and (2) the burden of the file maintenance. Currently about one-half of one analyst's time is spent keeping this file up-to-date. Her time is spent in the tedious process of keeping track of additions and changes to the OB file. Every 3-4months these changes are transcribed onto sheets which are punched up and run into the file by OCS.

4. Outlook for the Future:

25X1B0a Thought has been given to re-formatting the file [redacted] We hesitate to begin this project because: (1) It would require 1-2 man-years to put the required data in suitable machine form; (2) it has not yet been possible to evaluate other projects which would affect our file, i.e., the COINS system and EEIs; (3) alternative methods of maintaining the OB first should be considered. The most promising approach to keeping order of battle information now appears to be a system which allows retrieval and file update -- online. We hope steps can be taken in this direction, perhaps by way of the AXMASTER project.

III. AXMASTER 25X1A9a

Responsible Branch: SF/D [redacted]

1. Description:

AXMASTER originated in 1966 under the sponsorship of the Office of Research and Development. Briefly, the hardware components employed in the system are: An IBM 360-40 computer and ancillary equipment, and the Bunker-Ramo BR-90 display console. Our data base includes the Target Data Inventory, the Consolidated Air Defense Order of Battle, and the OSR SAM file. The system plots our data base on the face of the console screen, overlays categories of information, geographically correlates and ranks the data, and records the results by means of a machine printout.

2. Objectives of the System:

ORD's objective was to develop new approaches and hardware techniques to aid the analyst. Our objectives were twofold: (1) to develop new analytic techniques, and (2) to determine Soviet defensive priorities. The development of the system has been accomplished [redacted] 25X1A5a1
25X1A5a1 [redacted] with the Support of OSR and ORD. Phases I through III were concerned with the design and complete implementation of the system. Phase III ended last month.

3. Current Status:

Currently, phase IV has been contracted for, and the specific phase IV objectives are now being finalized. Phase IV objectives are generally directed toward increasing the speed of the system by improving several operating routines and by lowering machine file search times. Also being considered are improvements which would provide greater analytical power to the operator, such as: (1) an online library of statistical programs and, (2) the capability to sort on the operators online input to the file. An important part
25X1A5a1 of Phase IV is a [redacted] study of the feasibility of using the IBM 2250 console in place of the BR-90. The 2250 is simpler and less expensive, and may be suitable to our needs.

Currently the investigation of Soviet defensive priorities is underway. We are now assembling the data required to do a multiple correlation analysis. We intend to correlate SA-2 defenses of 30-40 Soviet cities, with various attributes, i.e., steel POL, etc. This spring we will attempt to assemble our findings in a report on Soviet defensive priorities.

4. Outlook for the Future:

The capabilities of the system will allow us to analyze Soviet defensive priorities at a level of detail not before possible. The potential of the AXMASTER system, however, will not be fully exploited until the system can be directed to other substantive problems. The time is approaching when the original substantive objectives of AXMASTER will have been satisfied.

Our goal in the coming months is to find broader implications for the system. Potential uses for the system must be studied and laid out in detail. It is our feeling that we are now limited more by our lack of applied imagination than by the lack of suitable computer programs and equipment.

IV. "ORPHAN"

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Responsible Branch: SF/O [redacted]

1. Description:

The SF/O computer project "Orphan", soon to be re-christened, is a fairly simple information storage and retrieval system containing a large volume of data on Soviet strategic missile forces. It was conceived and created by [redacted] in January 1967.

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2. Objective of the System:

The original objective was to create a file from which trends and projections could be automatically computed. However, preparing data specifically for computing trends and making simple linear correlations took longer than counting items on printed and sorted lists and calculating trends on a desk calculator. Perhaps as compensation for this failure, the file embodied potentials not obvious in the earliest stages of its development.

3. Current Status:

At present, the program includes information on ICBM complexes and identified sites; there are 25 such complexes and almost 1,000 sites.

4. Outlook for the Future:

In the future, the program will include information on IRBM and MRBM deployment, missile production and static test facilities, regional storage facilities and SRF communications activities. While the full scope of possibilities has not been fully studied, the program probably would benefit from developing on an ad hoc basis rather than as a rigid, formal system. This would avoid direct competition with other systems such as the COMIREX target file and the FMSAC MISTAC file and make it easier to handle specific problems as they arise.

One advantage of the file is its compatibility with other automated data files. These include the NPIC Blip file, organized according to the NPIC identifier; the DIA AIF (Automated Intelligence File) tapes, organized basically by the COMIREX target number. In addition to including these identifiers for compatibility, the IAS ICBM launch group and site identifiers are listed, as well as the TDI site numbers for cross reference. With all of this information, any of the aforementioned systems should be accessible through their basic identifiers and should reduce the inconvenience and time loss caused by the multiplicity of identification systems.

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A second advantage of the file is its potential as a tool for analyzing [redacted] coverage of subjects of interest to OSR. It is in no way meant to compete with the COMIREX analysis of reconnaissance in connection with requirements. Rather, our coverage data would be used (1) to prepare priorities for forthcoming missions, (2) to analyze our own past determination of priorities, (3) to develop internal requirements for coverage as contributions to the CIA member of COMIREX, and (4) to highlight important facts resulting from a mission.

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A third advantage of the file is its potential as a repository for data on the status of [redacted] 25X1B0a3 Maintenance of this information on a regular basis will provide basic data for trend analysis and projections of force levels for national estimates and for periodic reports on the status of Soviet deployment.

A fourth advantage, less tangible than the preceding three, relates to the inclusion of [redacted] 25X1B0a, and other information which may reflect readiness or alert conditions. When a sufficient volume of this information is on file -- in manipulatable form -- [redacted] should be less difficult than at present. 25X1B0a 25X1B0a3 25X1B0a [redacted]

Although publication of information in the file was not an original objective, there are obvious capabilities and benefits from having data in publishable form. The GMAIC Deployment Working Group's periodic revision of the publication Evaluations of Soviet Surface-to-Surface Missile Deployment is one example of an existing publication which could benefit from computer printing. The SF/O ICBM status report also could include an occasional addendum which would provide a detailed data base on deployment. In addition, reconnaissance priorities could be printed on computer facilities for use by analysts in preparing new priorities and for contributions to those responsible for COMIREX targeting.

V. Soviet Military-Economic Planning Model

Responsible Branch: PA/M

1. Description:

The Soviet Military-Economic Planning Model is an econometric model which allocates productive capacity and output through time toward satisfying a specified set of economic objectives -- plan objectives.

2. Objectives:

Plan objectives can be formulated in terms of: (1) the economic well-being of the population, (2) military programs, (3) foreign trade, and (4) economic growth. The economic planner must transform these objectives into output objectives.

a. The first three -- civilian consumption, military programs, and import and export levels -- can be quantified as schedules of output (by commodity type and year) to be met during the course of the planning period. Thirty-eight commodity types, or sectors, are used in the present military-economic planning model.

b. Transformation of the economic growth objective into sector output objectives is more complicated. The most rational approach is to set a given combination of sector outputs (or capacities) to be maximized in the terminal year of the plan.

By capacity we mean the available capital stock and the capital-output ratios. To produce a given commodity, however, material inputs as well as capital capacity are required. The national inputs are defined by the inter-industry coefficients, or a_{ij} coefficients of input-output analysis. Output and capacity must be in balance to produce a specific set of sector outputs or commodities.

Given the capital capacities by sector in a base year, our model makes an optimal allocation of output: (a) first to satisfy our annual objectives -- i.e., civilian consumption, military consumption, and exports -- and (b) second to the capital formation (investment) required to maximize the particular outputs specified for the terminal year of the planning period.

The basic purpose of SMEPM is to facilitate analysis of the economic alternatives open to the Soviet policy-makers. In particular, it is to be used to provide a framework for assessing:

a. The economic feasibility of projected military programs, and

b. the cost of feasible military programs in terms of competing economic objectives.

The procedure is as follows:

a. First, we postulate a set of nonmilitary objectives for the Soviet planner: civilian consumption schedules, export schedules, and the combination of outputs to be maximized in the final year. The closer we can approach the Soviet planners' thinking on these objectives the more meaningful will be our results.

b. Second, we enter into the plan the projected military program that we intend to assess. This requires transformation of the military program first into SCAM values and then into input-output sector values.

c. We then run the model. If the plan objectives are feasible, we get a complete input-output table for each year of the planning period. If they are not feasible, the model will stop and tell us which sector is the bottleneck. If we choose, we can then reduce either the military or the civilian objectives until we get a feasible plan, i.e., we can ascertain what has to give to make the military program fit.

d. If the plan is feasible, we can determine how much the military program, or any part of the military program, costs in terms of sacrificed economic growth. Similarly, we can run two alternative military programs and determine their relative costs in terms of sacrificed growth. For example, if one military program results in a 10 percent annual rate of growth in GNP and a second program in a 15 percent growth, the opportunity cost of implementing program 1, rather than program 2 is a one-third reduction in the rate of growth of GNP. We will also see how the individual economic sectors are affected.

The objective of the SMEPM, then, is to permit the use of the above types of analysis:

a. To help in formulating OSR military projections.

b. To test NIE and NPPP projections for economic feasibility.

c. To assess the economic impact of military projections, including identification of critical sectors.

d. To assess announced Soviet economic plans (or changes in plans) with respect to military program implications.

e. To use in conjunction with the Arsenal Exchange Model: (1) to assess the feasibility and opportunity costs of attaining given military postures, and (2) to conduct cost effectiveness studies in terms of true resource scarcities.

f. To assess the economic ramifications of disarmament schemes.

In short, we believe the SMEPM represents a breakthrough in analytical technique for assessing Soviet planning problems.

3. Current Status

First, we have completed the theoretical work on the basic model. That is, we have formulated the planning model described above into a mathematical program which will provide an optimal solution.

Second, we have developed the data inputs necessary for a test run of prototype model using (a) capacities and coefficients applicable to the Soviet economy in 1959, (b) a one-year capital gestation period, and (c) three alternative economic plans for analysis. The three economic plans selected for analysis have common civilian objectives, varying only with regard to the military objective:

a. First is a military program adapted from SCAM 11-4-67, for the years 1959-63; this is intended to demonstrate a feasible plan.

b. Second is a military program which doubles the military objectives of the first program across the board; it is intended to demonstrate an infeasible plan, and

c. Third is a military program which is identical to the first program less the values associated with the missile portion of the strategic attack program; it has been selected to demonstrate use of the model in deriving the cost of a military program in terms of sacrificed economic growth.

The adaption of the model to the computer makes use of the Mathematical Programming System (MPS) for the IBM 360 computer. The program for feeding MPS has been written

and is in the final stages of debugging -- this should take about another week. We discovered last week, however, that the IBM 360-40 computer -- the computer on which MPS has been loaded and checked out -- is not large enough for our model. An MPS package for the IBM 360-65 computer, which has the right capacity, has been ordered and should be in by the end of this week or early next week. It will take about 10 days after receipt of the package to complete the loading and checkout of the system. Thus, we are about three weeks away from running the model.

4. Outlook for the Future:

The next phase of development will bring the model to an operational status. This will involve: (a) bringing the production function, and (b) capital formation inputs to the model up-to-date and (c) quantifying the military and economic scenarios that we choose for analysis.

a. The production function inputs include:

(1) The values of fixed and working capital at the beginning of the planning period,

(2) The fixed and working capital coefficients (b_{ij} and s_{ij}'s.)

(3) The interindustry coefficients (a_{ij}'s.)

b. The capital formation requirements of the model are:

(1) Capital depreciation schedules for each year of the plan,

(2) The structure of capital by type in each sector,

(3) Capital gestation periods by sector.

c. The entering into the model of the particular scenario that we wish to assess requires quantification of:

(1) The annual minimum civilian consumption requirements,

(2) Annual export requirements and import supply,

(3) Annual deliveries of output to the military program.

The capital values and coefficients and the depreciation schedules can be brought forward to 1968 with a moderate research effort and a little computer time. These should be completed this Spring and will give us an operational capability assuming 1959 technology and a one-year capital gestation period. To update the technology, estimate realistic capital gestation periods, and improve our transformation of the SCAM expenditure categories into sector outputs, however, will take a substantial research and analysis effort requiring analytical capabilities we do not at present have in OSR. The size of this effort has been spelled out in a memorandum of 29 December 1967. To date, our effort has involved two analysts full-time, with considerable support from OCS. Continued development and use of the model will require support from FBIS equivalent to 2 analysts, and 3 other survey analysts -- hopefully one from OER and 2 half-timers here in OSR. In addition, the development of meaningful plan scenarios will call for all of the imagination and expertise that we can muster, beg, borrow, or steal.

VI. Arsenal Exchange Model

Responsible Branch: PA/M

1. Description:

25X1A5a1 The Arsenal Exchange Model is a computerized strategic war simulation model that was developed by the [redacted]. It simulates two-sided nuclear exchanges in various scenarios, under different conditions.

2. Objective of the Model:

The model is used to study the strategic relationship from the Soviet viewpoint. This encompasses:

a. Force evaluation, in terms of capabilities such as assured destruction and damage limitation;

b. Force structuring, by analyzing aggregate capabilities and optimum courses and by use of marginal analysis and cost-effectiveness;

c. Sensitivity analysis of the significance of programs and systems' characteristics;

d. Evaluation of Soviet policy, in terms of what can be inferred from and related to other information; and

e. The provision of inputs to broader studies, i.e., inputs to be used with SMEPM to determine the economic impact of alternative strategic programs.

3. Current Status:

The model is operational and has been used to examine the strategic relationship. The results have contributed to several major OSR products. 25X1A5a1

25X1A5a1 Additional developmental work is being done by [redacted] to improve capabilities, particularly of the ABM routines and also to introduce a capability to do optimum force structuring.

The model compares favorably with other strategic simulation models in use.

4. Outlook:

By late Spring, it is expected that the model will have been used to extend our examination of the strategic relationship through use of additional scenarios and to increase projections from several to 10 years into the future. We also expect to have done more work on techniques applicable to force structuring, including marginal analysis and cost-effectiveness. Finally, by late Spring, we hope to have made strides towards tying the model to SMEPM, and otherwise using its output in multi-disciplinary studies. Output of the Arsenal Exchange Model is to be oriented towards the Office contributions to NIE 11-8, 11-3, the NIPP, a brief on the strategic relationship, and other papers.

Beyond FY '68, the possibilities are many. We expect to continue to develop the above capabilities and hope to have this work lead to a capability for a broader consideration of the strategic problems. This could lead to more development of the model as well as to the use of other kinds of models.

VII. NASA Launch Vehicle Cost Model 25X1A9a

Responsible Analyst: SF/S [redacted]

1. Description:

This model was designed by General Dynamics to assist NASA in identifying the developmental and operating costs of US launch vehicles.

2. Objectives of the System:

To apply this model to Soviet space vehicles using specifications defined by US estimates of Soviet space programs.

3. Current Status:

The Office of Computer Services has had considerable difficulty in getting this model to run on Agency equipment. They expect it shall continue to cause them problems every-time they try to run it. We do not plan to ask OCS to continue work on the General Dynamics model. The Marshall Space Flight Center (Huntsville, Alabama) has indicated a willingness to run this model for us when we require it because our use of the model is expected to be infrequent.

4. Outlook for the Future:

We may have some future requirement for this model, but we do not expect it to occur very often. We will handle each requirement to use the model as an ad hoc venture. Meanwhile, the Space Systems Branch is investigating other cost models used in the US space program community.

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[redacted]

Chief
Planning Staff, OSR

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